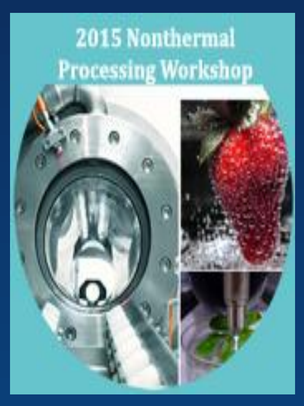

Non-thermal technologies for *Alicyclobacillus acidoterrestris* inactivation in apple juice

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Introduction

A. acidoterrestris
- Thermo-acidophilic bacteria.
- Survives to pasteurization processes.
- Suggested as the target to be used in the design of adequate pasteurization processes.

Heat processing
- Adverse effects on sensory and nutritional characteristics of foods.

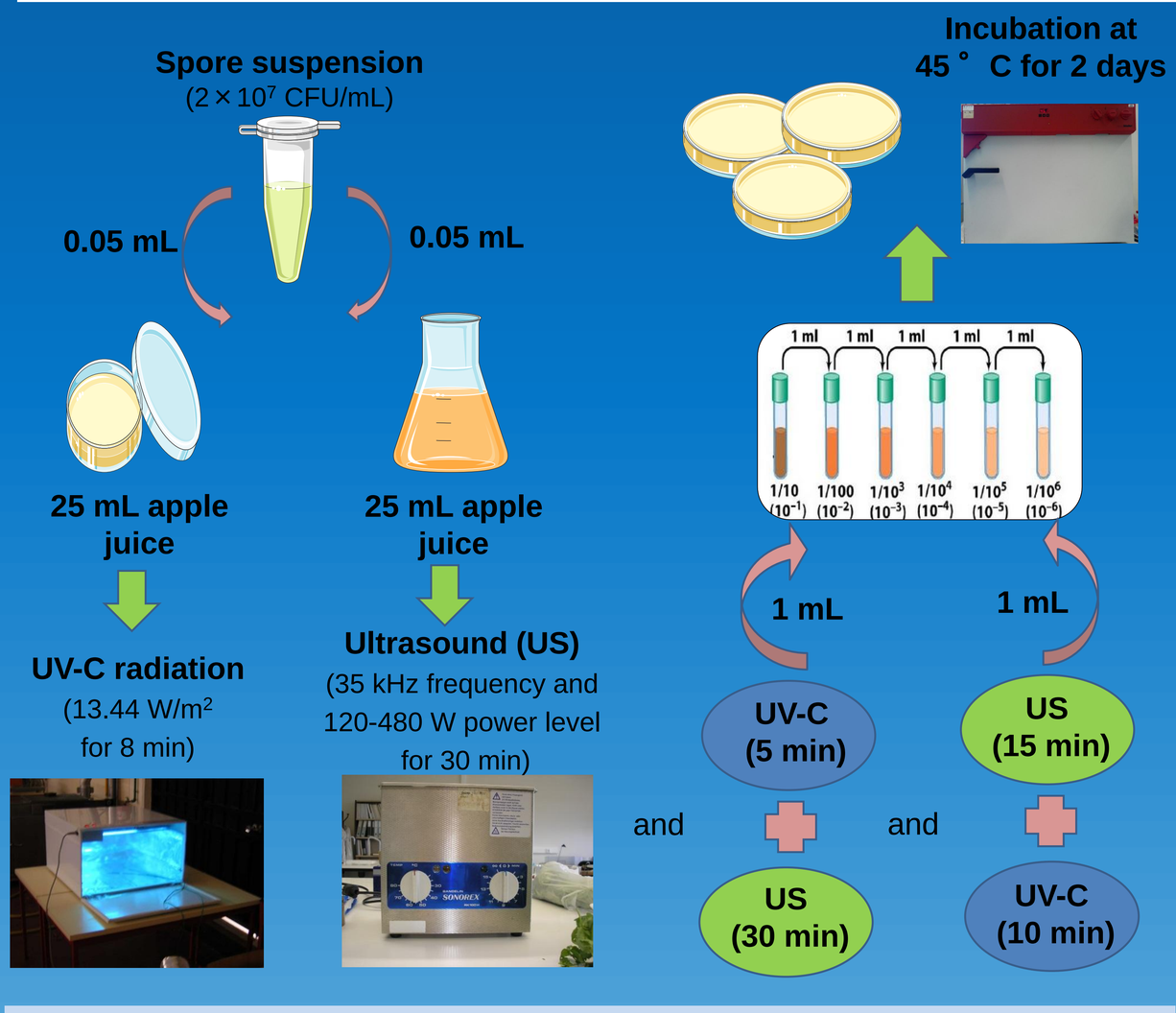
Non-thermal technologies
- Potential for inactivating spoilage and pathogenic microorganisms.
- Minimizing quality losses in terms of flavour, colour and nutritional compounds.

Ultraviolet radiation (UV-C)
Microorganisms that are exposed to UV-C light are affected at DNA (deoxyribonucleic acid) level, which compromises their survival.

Ultrasound (US)
Power ultrasound is capable of inducing cavitation to inactivate microorganisms in foods.

Objectives
The main objective of this work was to study the influence of UV-C radiation, ultrasounds, and combinations of both treatments on *A. acidoterrestris* inactivation in apple juices.

Materials & Methods



Data analysis

$$\log\left(\frac{N}{N_0}\right) = -kt \qquad (1)$$

N_0 is the initial microbial load of the juice (CFU/mL), N the microbial load (CFU/mL) at a given treatment time t (min), and k the inactivation rate (min^{-1}).

Results & Discussion

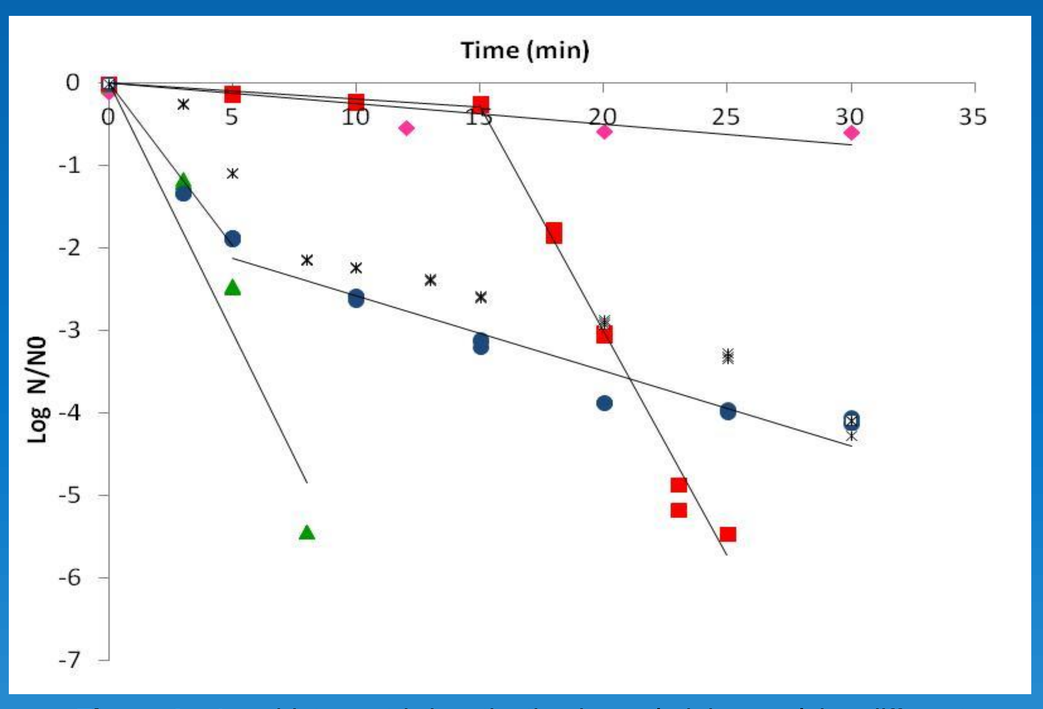


Figure 1. *A. acidoterrestris* inactivation in apple juice applying different treatments: (▲) UV-C, (♦) US, (■) US+UV, (●) UV+US and (⁎) 95 ° C Lines represent model fits for each treatment individually (eq. 1).

Table 1. Inactivation rates of *A. acidoterrestris* spores in apple juices obtained for each non-thermal treatment; confidence intervals at 95% ($CI_{95\%}$) and correlation coefficients (R) are included.

Treatment	First treatment		Second treatment	
	k(min^{-1}) ± $CI_{95\%}/2$	R	**k**(min^{-1}) ± $CI_{95\%}/2$	R
UV-C	0.606±0.069	0.97	-	-
US	0.025±0.005	0.76	-	-
UV+US	0.393±0.025	0.99	0.091±0.014	0.96
US+UV	0.019±0.002	0.96	0.546±0.035	0.99

Conclusions

✓Ultrasounds had a minor effect on *A. acidoterrestris* inactivation, reducing only 0.6-log after 30 minutes of treatment.
✓UV-C radiation decreased drastically the number of spores (around 5-log reduction, which attains FDA requirements) after 8 min of treatment.
✓The combined treatment US followed by UV-C resulted in higher inactivation (around 6-log reduction) after 25 min of exposure.
✓Inverting the order of treatments, *i.e.*, UV-C followed by US, a decrease of approximately 4-log of initial microbial load occurred after 30 minutes of treatment. These results are similar to the ones obtained with a thermal treatment at 95 ° C.
✓It can be concluded that UV-C radiation and combined treatments of UV-C followed by US are promising treatments, with a drastic impact on the loads of *A. acidoterrestris* in apple juices.

Acknowledgements
Andréia Tremarin gratefully acknowledges to CAPES-Brazil for the financial support. Teresa R.S. Brandão gratefully acknowledges to Fundação para a Ciência e a Tecnologia (FCT) and Fundo Social Europeu (FSE) the financial support through the Post-Doctoral grant SFRH/BPD/101179/2014. This work was supported by National Funds from FCT through project PEst-OE/EQB/LA0016/2013.

CAPES
POPH PROGRAMA OPERACIONAL POTENCIAL HUMANO
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UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional
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